Florida Department of

Memorandum — Environmental Protection

TO: Bureau of Waste Cleanup Staff
District Waste Program Administrators
District Waste Cleanup Supervisors
District Tanks Supervisors
Local Program Coordinators
Interested Parties

FROM: Douglas A. Jones, Chief
Bureau of Waste Cleanup

DATE: August 16, 1993

SUBJECT: Monitoring well construction specifications and related issues

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Until now we have relied on the environmental consulting companies, during installation of monitoring wells <u>for assessment of petroleum contaminated sites</u>, to follow EPA's "Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells", EPA/600/4-89/034, March 1991, or unwritten Departmental guidelines, or (with necessary modifications) those in effect for construction of compliance wells (Rule 17-761.640, FAC). In addition, some general specifications and requirements for water supply wells can be found in Chapter 17-532, FAC. Because of problems encountered during review of some Contamination Assessment Reports, it has become apparent that a set of written guidelines outlining the Department's policy on this issue is necessary. The following discussion deals with detailed well construction specifications; it is assumed that generally accepted practices will be followed during monitoring well installation for those tasks not discussed here. Also outlined is the Technical Review Section's position on related issues, such as the spatial (horizontal and vertical) distribution of monitoring wells used for plume delineation during the assessment phase of each project.

A. <u>Specifications applicable to any monitoring well, and general comments</u>:

1. If a Water Management District has any specific requirements which are different from those discussed in this Memorandum, the WMD's requirements should take precedence unless an exemption is approved.

2. Before monitoring wells are installed, it is recommended that a soil assessment be performed in order to identify areas of excessive soil contamination, since the first phase of monitoring well installation should be largely (although not solely) dependent on the results of the soil assessment.

3. In most situations, hollow stem augers should be used for installation of water table monitoring wells and even for vertical extent monitoring wells. However, mud rotary will be necessary in some cases, particularly during installation of deeper wells or when drilling through limerock or very fine-grained, runny sands (in this case, drilling fluids should consist of native bentonite mud with no additives, such as Aquagel Gold Seal, Natural Gel, Pure Gold Gel, or equivalent). Wells hand-augered or "jetted-in" usually are not acceptable for monitoring purposes, although they may be allowed in some specific locations (prior approval should be obtained to confirm the applicability of these techniques). As long as no confining unit is breached, direct push wells are acceptable for screening purposes, in order to minimize the number of wells needed to define the plume (this approach is most effective when used in conjunction with a portable GC). If the site is in one of the reimbursement programs, it will be necessary to demonstrate that the method was cost-effective.

4. For permanent monitoring wells, a minimum 2-inch filter pack annulus is required. The internal diameter of hollow stem augers should be of sufficient size to ensure that this requirement is met. If mud rotary is used to advance the borehole prior to well installation, the bit diameter should be of sufficient size to achieve this objective.

5. It is strongly recommended to use 2-inch diameter PVC, since this size usually is sufficient for groundwater sampling and other necessary operations. Two-inch diameter wells are less expensive to install, minimize disposal problems and also save time (and therefore money) during sampling because they can be purged faster than 4-inch diameter wells due to the lower volume of water that needs to be withdrawn. However, it is advisable to install 4-inch diameter wells:

a. In areas where free product is known or suspected to be present, because those larger wells are more efficient for free product recovery;

b. If the well is expected to be used for long term monitoring;

c. If the well is expected to be used for short term pumping, or as a recovery well during site remediation; and

d. In areas with deep water tables, in order to allow development and purging operations by means of a 4-inch submersible pump if 2-inch pumps are not available.

6. Different well sections should be mechanically connected (thread-jointed or bolted); glued or welded wells are not acceptable. Minor well repairs are acceptable if the upper portion of the solid casing became damaged or needs to be extended due to regrading of the site. The repair can be accomplished by means of a slip coupling, which must be attached to the existing section with stainless steel screws (the length of the latter must be selected to prevent them from reaching the inside of the well).

7. The preferable slot size is 0.01-inch; if 0.02-inch (or greater) slotted screens are used, then care must be taken to use a coarser sand pack (some guidance is provided in the attached table, from the October 1990 ASTM document "Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers"). The 1990 ASTM document states that the sand pack (filter pack) usually is selected to have a d-30 (30% finer) grain size that is about four to 10 times greater than the d-30 grain size of the hydrologic unit being filtered. Use of a filter sock in lieu of a sand pack is not acceptable.

8. The use of fine sand instead of bentonite above the sand pack is strongly recommended. Because it cannot be tremied in, bentonite tends to "bridge" the annulus in vertical extent wells, thus a proper seal is not attained. Also, it

dehydrates in monitoring wells that straddle the water table since the seal is located in the vadose zone. If bentonite is used, enough time should be allowed for hydration to occur and seal the annular space before grouting the well. If not, cement may enter the well, causing cement contamination which can be evidenced by an unusually high or elevated pH.

9. The annular space of the monitoring wells should be grouted with neat cement, or with a cement/bentonite mix (up to 6% bentonite by weight); pure bentonite or a bentonite slurry is not an acceptable grouting material. If a cement/ bentonite mix is used, care should be taken to mix the materials thoroughly in order to avoid leaving lumps of bentonite in the grout.

10. The wells should be developed only after the grout is allowed to cure, and sampling should be performed at least 24 hours after development. Fluids (including water) cannot be added to aid in development. If a well does not produce enough water it may be necessary to replace it with another well screened in a more transmissive stratum of the aquifer(in such areas it is important to make full use of lithologic information to identify the more transmissive zones, and it may be advisable to use longer screens). "Disinfection" of wells by means of soap, alcohol or any other compound is prohibited.

11. Drill cuttings and drilling mud should be screened with an Organic Vapor Analyzer during the drilling process to determine the best, most cost-effective disposal of the material determined to be contaminated (usually, <u>only soil generated from borings conducted during soil assessment</u> may be returned to the borehole as long as confining layers have not been penetrated):

    a. If unpaved areas are available where soil contamination is present, small amounts can be disposed of on-site, selecting an excavated or low area in the most highly contaminated zone, with the least contaminated soil on top and covered if possible with at least six inches of

soil that is no more contaminated than the background soil, as long as there is no potential for runoff.

b. The contaminated material can be land-farmed if small amounts were generated and if more than 200 feet from the nearest residence or public gathering place.

c. If the preceding options are not appropriate (particularly if significant petroleum vapors are detected and/or if a relatively large volume was generated), the contaminated material should be stored in metal drums, or placed on and covered with black plastic sheeting (4 mil minimum thickness) and bermed where necessary. At the latest, this material should be treated or disposed of during implementation of the Remedial Action Plan, preferably concurrently with other contaminated soil during remedial activities.

12. Disposal of development water and purge water is discussed in detail in Section 4.4.5.3 of the document "Department of Environmental Regulation, Standard Operating Procedures for Laboratory Operations and Sample Collection Activities", September 30, 1992. The following is a summary of the approved alternatives for disposal when the water is known or suspected to exceed the Maximum Contaminant Levels listed in the FAC (Chapter 17-302, 17-520, 17-550 or 17-770):

a. It can be contained on-site in temporary storage until it is characterized by the appropriate, approved analytical method(s).

b. It can be decontaminated on-site by means of a portable treatment system (air stripper, carbon, etc.), with any disposal option (disposal to surface water must be conducted in accordance with General Permit FLG830000).

c. It can be discharged in the area around the well from which it was pumped, as long as it has been determined that the soil is excessively contaminated at the surface, and if it will infiltrate the same aquifer zone from which it was derived (or into a more contaminated aquifer zone).

d. It can be transported to an off-site facility such as a sewage treatment plant/sewer system, as long as prior approval is obtained from the wastewater treatment plant operator and all applicable permits are obtained from the wastewater facility or municipality.

If it has been determined by means of a portable GC that the groundwater is not contaminated, it is acceptable to pour it on-site, preferably on paved areas. The portable GC must be calibrated, and equipped with a column; an organic vapor analyzer or similar instrument is not acceptable for this purpose.

13. The tops of permanent wells should be protected by either a standup metal casing or flushmount manhole set in a concrete pad which is sloped away from the well to prevent surface infiltration. The top of casing should be sealed with a water tight cap for flushmount wells, whereas PVC slip caps are sufficient inside standup, lockable, metal protective casings. All permanent monitoring wells must be secured at all times (except during purging and sampling) by means of quality locks. Once it is determined that the wells are no longer needed, they must be abandoned according to the appropriate Water Management District requirements.

14. Boring Logs and Well Construction Logs should be included in the reports submitted for review. In addition, a table (which should be updated as new monitoring wells are installed) should be provided summarizing pertinent well construction data for all on-site wells (compliance wells, monitoring wells, recovery wells, production wells) and all off-site assessment wells:

a. Required: name and number (in agreement with the site map), date of installation, top of casing elevation, diameter, total depth, screened interval, and length of stickup (if completed above grade).

b. Optional: static water level (updated as appropriate), well placement rationale, well type, drilling method, slot size, and lithologic unit monitored.

B. Water table wells:

1. Normally, the horizontal extent of groundwater contamination should be defined through installation and sampling of permanent water table monitoring wells. Temporary wells usually are acceptable only in off-site locations where permission to install a permanent monitoring well cannot be obtained, for closure assessments, or in sites suspected to be uncontaminated, where one sampling event may be sufficient to complete the assessment (in the latter case, the well should be converted to a permanent well if contamination is identified). A temporary well should be sand-packed and developed properly before it can be acceptable for groundwater sampling. Even if a permit for temporary well installation is not needed, the appropriate Water Management District should be notified to determine plugging requirements.

2. The screen usually should be 10 feet long, although it is acceptable (and often advisable) to use 15 feet in sites with a deep water table (located 20 or more feet below land surface [BLS]).

3. The screen should intersect the water table at all times if possible, and should be placed taking into account that fluctuations in the water table occur (if site-specific information on water level elevation data is not available, at the time of well installation it is particularly important to be aware of whether it is the dry or rainy season). For areas with shallow water tables (less than six feet BLS) it is recommended to screen the wells between two and 12 feet BLS. If the water table is less than two feet BLS, the requirement that the screen must intersect the water table does not apply because it is not recommended to place the top of the screen less than two feet BLS.

4. If the water table is less than two feet BLS, it is recommended that a piezometer (with the screened interval intersecting the water table) be installed in areas where the presence of free product is suspected. The piezometer

should not have more than five feet of screen, and the whole length of the annular space can be backfilled with native sediments.

5. Proper spacing of water table wells is important for accurate plume delineation during the assessment phase, and in order to avoid an unnecessary (and costly) overdesign of the remediation system, if needed once the Contamination Assessment Report is approved. For typical gas stations, the wells should not be placed more than 30 to 40 feet apart unless these distances cannot be achieved because of physical obstructions. For larger plumes it is acceptable to increase the distances between wells based on site conditions. Typically, the distance between monitoring wells should be proportional to the size of the plume, as long as some monitoring wells are installed between source wells and perimeter wells to provide data on intermediate contaminant concentrations. On the other hand, it is not acceptable to increase the recommended distances based only on OVA data because they have proven to be unreliable to estimate the degree of groundwater contamination.

C. Vertical extent wells:

1. Vertical extent wells should be installed near, and slightly downgradient from, the water table well showing the highest degree of contamination. Therefore, it is advisable to sample the source wells (which are the ones expected to be most contaminated) and to determine the direction of groundwater flow before a vertical extent well is installed, in order to decide if the vertical extent well is needed and to optimize well location if it is.

2. The screen should be five feet long. However, it may be necessary to use 10 feet of screen if the sediments have low transmissivity, to attain a faster recharge.

3. If the lithology is fairly homogeneous, single-cased wells are acceptable, although it is highly recommended to install double-cased wells if significant contamination was detected in the upper zone. If the well needs to be screened below a

confining or semi-confining layer to verify lack of contamination in that stratum of the aquifer, multiple-cased wells are required, with a minimum of 2-inch annular space between casings.

4. The screened interval of a vertical extent well should be determined based on lithology and site-specific information, and to some extent on the concentrations detected at the water table wells (again, a portable GC can be very useful in determining optimum screen locations). Typically (if lithology is not a factor), the top of the screen of a vertical extent well should be installed about 10 feet (and no more than 20 feet) below the bottom of the screen of the water table wells (or of any vertical extent wells screened in the stratum immediately above).

5. If a vertical extent well shows significant contaminant concentrations, in addition to a deeper vertical extent well to define the vertical extent of contamination it may be necessary to install additional (at least two) intermediate depth wells similar to the contaminated vertical extent well, in order to define the horizontal extent of the groundwater contamination in that stratum of the aquifer. The decision on whether these additional wells are needed should be based on:

   a. Site lithology;

   b. A comparison of contaminant concentrations and head differences between the first vertical extent well and the water table well closest to it; and

   c. The results of the potable and irrigation well survey.

6. Water level elevation data should be obtained from vertical extent wells (in addition to water table wells) to determine the horizontal flow direction in the different strata of the aquifer, and also to determine whether a vertical hydraulic gradient is present at the site.

If you have any questions call the Technical Review Section or the Site Investigation Section, Bureau of Waste Cleanup, at (904) 488-0190.

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